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ABSTRACT

The emphasis of this report is on the words "frail" and "home." Previous conferences in this inquiry concentrated on the needs and interests of the aging well population. This meeting focused on those whose full enjoyment of life is hampered by impairments to mobility, vision, hearing, memory, etc. The main interest was in the cognitive and psychological requirements that arise out of such impairments or the threat of them. The charge was to identify and assess new technology applications that might in time be of special value to sizable segments of the elderly population. Factors which would be required to promote further development and acceptance were considered. Five themes emerged: (1) how to define "frail" and the implications of various definitions for focus; (2) the distinction between medical care for disease and injury and medical care for routine slow degeneration of aging; (3) adapting technology for use by the frail elderly themselves as distinct from adapting technology for use by caregivers; (4) American cultural attitudes toward the frail elderly as compared with those of other cultures; and (5) reliance on personal experience in relating to the subject. (ABL)

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Communications and Society
FORUM REPORT

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ADAPTING NEW ELECTRONIC TECHNOLOGIES TO SERVE THE FRAIL ELDERLY LIVING AT HOME

Report of an Aspen Institute Conference
Wye Woods Conference Center
Queenstown, Maryland
March 8-10, 1989

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INTRODUCTION

This is the report of the fourth meeting in The Aspen Institute's inquiry into harnessing new electronic communications and information technologies to meet the needs of elderly people.

We met at the Institute's Wye Woods Conference Center near Queenstown, Maryland, March 8-10, 1989. The 19 participants represented diverse perspectives—electronic product and service development, research on aging, social services, medical services, public policy, media, architecture and product and environmental design.

Three previous, related conferences had addressed the needs and interests of the well elderly:

The first meeting, in March 1987, defined some of the broad issues arising out of both demand and supply factors.

The second, in October 1987, examined different categories of technology-based innovations: (a) customized voice-communication services; (b) personal computer networking; (c) "electronic barter"; (d) microprocessor-controlled appliances and (e) electronic information kiosks. Some of the cases examined were already in the marketplace; others were in development.

In March 1988, a third meeting addressed the issue of attitudes, striving to match new electronic information products and services to the needs, desires and interests of elderly people.

This inquiry is part of the Aspen Institute's Project for Enhancing the Social Benefits of New Electronic Technologies, supported by the Markle Foundation.

ADAPTING NEW ELECTRONIC TECHNOLOGIES TO SERVE THE FRAIL ELDERLY LIVING AT HOME

Background

Two words are important to bear in mind in reading this report: "frail" and "home."

Previous conferences in this inquiry concentrated on the needs and interests of the aging *well* population. This time our focus was on those whose full enjoyment of life is hampered by impairments to mobility, vision, hearing, memory, etc.

Our main interest was the cognitive and psychological requirements—the knowledge and emotional needs—that arise out of such impairments or the threat of them. We wanted to find out how telecommunications, electronic media and computer-based technologies can enhance the personal independence of frail elders and prolong their ability to continue living in their own homes. Toward that end, we were most concerned with innovations that provide individual assistance in problem solving, information gathering, organizing and socializing.

Our charge was to identify and assess new technology applications that might in time be of special value to sizable segments of the elderly population. We considered what factors would be required to promote further development and acceptance. We tried to define the options these factors might suggest to business, research groups, foundations, senior groups and government agencies.

In doing so, five themes emerged:

1. How to define "frail" and the implications of various definitions for our focus
2. The distinction between medical care for disease and injury and medical care for routine slow degeneration owing to aging
3. Adapting technology for use by the frail elderly themselves as distinct from adapting technology for use by caregivers
4. American cultural attitudes toward the frail elderly as compared with those of other cultures
5. Reliance on personal experience in relating to our subject

These themes are reflected throughout this report, which is organized in accordance with the seven topics on our agenda:

I. The Frail Elderly—Their Needs and Interests

II. Emergency Alert Response Systems

III. TEL-C (TEL-Communicology) and REMATE (Remote Machine-Assisted Treatment and Evaluation)

IV. Robotic Technologies

V. Interactive Television

VI. Personal Computers

VII. Attitudes of the Elderly toward Technology . . . Attitudes of Technology Companies toward the Elderly

I. The Frail Elderly—Their Needs and Interests

The question is not whether technology can replace caregivers and social supports, but how much it can contribute toward the common goal of assisting and enriching the life of the frail elderly.

Abraham Monk, Ph.D.

Monk, Brookdale Professor of Gerontology at the Columbia University School of Social Work, started us off by clarifying what the frail elderly are *not*: they are not a marginal group or exceptional population on the fringes of society, he said. Their ranks are growing quickly and sizably. "If they live long enough, all those who are now well will end up frail," he said.

Monk had provided a wealth of material for our participants in a background paper prepared for the conference. For our purposes, he defined "frail" aged as those 75 years and older, often manifesting the following conditions:

- Sensory impairments
- Limitations in the performance of daily activities
- Behavioral problems that interfere with interpersonal relations
- Expressive and receptive communication problems
- Cognitive impairments—including memory loss and disorientation
- Loss of mobility
- Affective disturbances

Monk also provided a demographic view of the aged frail population and an overview of its social characteristics.

The most critical demographic issue, he said, is higher survivorship in the 75 and older group relative to all the aged. By the year 2040, life expectancy is expected to plateau at age 90, he stated. "This will have tremendous impact on the structural elements of society." Because older age is associated with higher rates of illness and disability, the increased number of very old people would be expected to lead to substantial increases in multiple chronic conditions and disability rates.

Women have a higher life expectancy than men, and they constitute the majority of the oldest cohort, Monk continued. Many are widows, often cared for by middle-aged and young-old female family members to a degree never before experienced. Will increased participation in the workforce enable these women to continue their caregiving role?

Monk cited a report issued by the Commonwealth Fund Commission which predicts that, in the next 30 years, the number of elderly people living alone will increase from 8 million to 13.3 million. By then, 85% will be females, many of them widows.

Both male and female seniors living alone are troubled by threats of impoverishment, loss of independence and social isolation, Monk reminded the group. Indeed, 43% of those who live alone are poor or near-poor. Many are troubled by serious chronic health and social problems, including depression and loneliness.

The effect of increased longevity on social attitudes is already becoming apparent, Monk reported. He recalled an example of multi-service senior centers established in the 1950s for the aged well. They served an important social function for those who were self-sufficient, but suffering from the loss

of friends or a spouse. As their frail counterparts now seek access to such establishments, they find intolerance for their impairments. Moreover, more than 90% of the centers that accept frail elders have no special programs for them. Perhaps as a result, the majority of frail elders rely on their families first, or friends and neighbors second, before approaching community centers for help.

"This is a family problem, a multi-generational problem, not an aging problem," Monk emphasized. Families are usually willing to provide care up through two hospitalizations, he said. After that, emotional and physical reserves become exhausted. The result: some 20 per cent of all older persons will eventually be institutionalized in a nursing home.

"Frailness," he summed up, "is a protracted, almost indefinite process which creates and produces emotional, economic and financial problems for the caregiver and, often, crisis for the family."

How can technology relieve this situation for both informal and formal caregiving systems? Monk suggested three areas where technology can assist older persons to:

1. Regain control of their lives and environments
2. Enrich the quality of their lives and enable them to overcome loneliness
3. Reduce the stresses and demands currently placed on caregivers

He reviewed a "laundry list" of technologies that had been covered in our readings, some of which would be discussed in forthcoming sessions:

Mid-level technologies, such as telephones, radios, televisions, VCRs, and computers, are operationally and economically accessible to frail elders, Monk said, and have the potential to assist people in attaining the above goals.

Telecommunications technology can aid in contact with health care providers and, through the use of computers with printers, help those with hearing loss. Interactive television can provide social services information to those in isolation.

Microcomputers can help improve health and cognitive functioning in decision-making matters related to banking, food purchases, and other aspects of daily life. Electronic innovations such as memory aids, "Smart Cards" and Personal Emergency Response Systems also hold promise for frail elders, Monk concluded, as devices to facilitate daily living.

Following Monk's presentation, the other participants jumped in to share their views.

Paul Grayson, an architect and consultant on living environments, cited his own experience with the resistance of well elders to having the frail join them in their dining rooms; they often suggested "separate" dining rooms. Society will require more and more adult day care centers for frail elders, especially for those who live alone or with an adult child, Grayson proposed.

Gari Lesnoff-Caravaglia is Executive Director of the University Center on Aging and the National Clearinghouse on Technology and Aging at the University of Massachusetts Medical Center. She reported the opposite experience of having observed frail elders who did not want well elders eating with *them*. She then raised the issue of nomenclature. "We don't know what a 70-year-old should be like," she said. "Terms like 'frail elders' and 'the young old' have become euphemisms like 'golden age.' We should use *direct* terms like septuagenarian, octogenarian, nonagenarian and centenarian." Lesnoff-Caravaglia has created a new term for those who reach 110—"centedecenarian."

K.G. Engelhardt is Senior Research Scientist and Director at the Health and Human Services Robotics Laboratory at Carnegie Mellon University. She pointed out the need to address the human

problems of ethnicity, cultural attitudes and inexperience on the part of caregivers. "These people are responsible for the application and monitoring of the technology," she said.

Robert Friedman, Chief of the Medical Information Systems Unit, University Hospital, Boston, agreed. "We must also consider the family doctor or other medical personnel who decide what technology should be used, as well as the family who pays the bill," he said.

Alan R. Meyers, Associate Professor, School of Medicine and Public Health, Boston University, endorsed the importance of concern for caregivers, including unpaid family members. Care of frail elders is just one aspect of the growing dependency burden in the entire population, he pointed out.

Paul Grayson voiced his knowledge of European attitudes toward keeping individuals in their homes. A European "Bill of Rights" for frail elders states that people should be able to decide where and in what circumstances they wish to live. "It is the responsibility of their community to help them remain there, by paying taxes and so forth," Grayson said. "The U.S. must find out what its elders want." Most, he speculated, want to be at home.

Andrew Dibner, Founder and Vice President, Lifeline Systems, Inc., voiced a slight disagreement. "What people want is determined by what they have heard in the past," he said. In the U.S., if the choice is a nursing home, they know that is an "ugly" choice and they do not want it, he explained. "In Europe, there are many choices—for example, little apartments like those in the Netherlands, where several elders with different disabilities share responsibilities. If we in the U.S. could experience some of those alternatives, we could change our attitudes."

Kerry Petrucci is a nurse specializing in clinical geriatrics at the National Institutes of Health. She offered the concept of "pre-homes," rehabilitation settings similar to halfway houses where technology assists hospital patients to develop strength and cognitive skills prior to returning to their own homes. "In some cases, these settings prevent a second hospitalization," she said.

Is the lack of such alternatives in the U.S. a reflection of the marketplace (and inadequate third-party reimbursement), or an American taste for self-reliance, independence, and private home ownership?

Len Singer is Associate Director and Associate Professor at the Center for Product and Environmental Design at Virginia Polytechnic Institute and State University. He emphasized the importance of acknowledging the values in our own American culture and the slowness of societal change.

"Independence is the hallmark of the American way of life," Singer pointed out. Citing his own experience designing bathrooms for the U.S. market, he described how manufacturers incorporate user response—a cultural element—in new product decisions.

"Don't just think that 'these people' will be easily educated into another way of life," he cautioned. Kerry Petrucci seconded the thought, recounting her frustration as a nurse sending patients home with adaptive devices they did not use. "You don't reverse frailty with technology," she said. "Education and home care support are required to help people adapt."

Scott Hauger, President of Applied Concepts Corp., suggested that we look at the technologies on our agenda in two categories:

1) *Care technologies* where use is directed by a prescribing authority (e.g., a doctor)

2) *Assistive, consumer technologies*, which a user applies to do things that otherwise are no longer possible

As an example of the second, Hauger told of his 90-year-old grandmother who bought a fax machine so her daughter could balance her check book for her.

But most of the group thought that this remarkable woman must be the exception, rather than the rule. "People who become frail are not the same as they were before," said Margo Holm, a Post-Doctoral Fellow in Rehabilitation Research at the University of Pittsburgh. "After a stroke, for example, their habits, patterns and values change."

Holm told of two models—adult day care centers and "pod system" housing units—for assisting frail elders.

"Why adapt everyone's home bath and laundry when community care centers can provide an efficient and cost-effective system for bathing and laundry as well as socialization?" she asked.

The "pod system" is another efficient, cost-effective system. Groups of frail elders live in multiple units ("pods") under the supervision of unit managers, often young couples in adjoining units, who are responsible for their care. The units can be connected to the managers' apartments through phone or video; even banking can be handled electronically from the site. "These semi-protected environments, which have been used successfully with head-trauma victims, encourage dignity," Holm said.

The group continued its discussion of the triad of culture, environment and technology, and Abraham Monk again raised the issue of the growing number of people living alone. "They will have fewer relatives on whom to rely when they reach old age," he said. In fact, the Commonwealth Fund report mentioned earlier cited higher rates of impairment among people living alone. "Group and cluster homes must play a role," he said, "but that will not happen without changes in public policy, which is currently adverse."

Michael Rice, Director of the Program on Communications and Society for The Aspen Institute and the conference moderator, asked for a profile of the elderly person at home, increasingly beset by anxiety and fear of making it alone: "Families and friends become distant . . . less energy . . . poorer health . . . attached to living environment . . . doesn't want to move . . . lonely . . . bad weather is frightening. . . ."

Robert Friedman insisted that we must define the person's disability in terms of types (cognitive, motor, sensory, etc.) and degree in order to address the question. Margo Holm said that there was danger in "seeking a mean." Frail elders suffer from multiple problems, she explained, "all in different amounts at different times."

Paul Grayson suggested that financial security—and fear of loss of control—were of most concern. Scott Hauger added transportation to the list. Gari Lesnoff-Caravaglia pointed up the mental health issues. "Frail elders grieve over their lost selves," she said, "and this hinders their ability to adapt to technology."

Indeed, several others agreed, well elders separate themselves from the frail in terms of class and see themselves as being better able to survive. For both the well and frail, the idea of nursing home care becomes equivalent to losing control of one's destiny.

The concept of living independently is very complex, Michael Rice pointed out as the session drew to a close. To what extent technology could answer the need would be explored throughout the rest of the conference.

II. Emergency Alert Response Systems

Also with us at Wye was Andrew Dibner whose Lifeline system of emergency alert has been in the marketplace for 10 years. Lifeline links subscribers to emergency personnel via a lightweight (two-ounce) plastic transmitter worn on a cord around the neck or on the wrist. When the wearer is within 200 feet of his or her Lifeline receiver, located by the telephone, and pushes the button on the transmitter, a

signal is sent to the receiver, which causes the phone to dial the nearest of 2,400 community-based Lifeline emergency response centers, or the National Lifeline Service Center in Watertown, Mass. Once the connection is complete (within 30 seconds), the phone becomes a speaker phone and the emergency center operator is able to inquire about the nature of the problem. (Almost all of the 2,400 centers are hospital-based.) Help is quickly arranged if necessary, or if there is no response.

Some 200,000 Lifeline units have been sold in the U.S. and Canada. (Canada is the fastest growing market because of a national unified health system that benefits from earlier discharge from hospitals and delayed nursing-home entry.) The equipment and service average $30-35 per month.

Dibner reported on the growing popularity of Personal Emergency Response Services (PERS) throughout the world. PERS have been especially successful in Scandinavia, England, France, West Germany and Japan, he said. Currently, Dibner is organizing the first International Symposium on Personal Emergency Response Services.

The participants viewed a marketing tape for Lifeline which included actual testimonials by users ranging from frail elders to a young single woman who had purchased the product as a security device for her urban apartment. Most Lifeline users are in their 70s and 80s, however, and 80% are women. While the company has experienced a certain resistance among elders in the marketplace (adult children often buy the product for their parents), the acceptance rate is over 90% once the product is in the home, Dibner said.

A waterproof button, long-life batteries, a smoke detector, and a special unit for common areas in retirement homes are some of the recent improvements in Lifeline. UL technical standards have now been developed for PERS products, Dibner said, but factors related to human interface (e.g., the size of PERS buttons) are not regulated.

Dibner cited two problems the company was addressing at this time.

1) About one-third of those who could benefit from Lifeline refuse it because of stigmatization. They say they would "feel more dependent" and that "life would be more complicated."

   (Len Singer suggested that perhaps acceptance would come gradually, as with seatbelts. Margo Holm raised the possibility that potential users would be more receptive if the device were prescribed by a doctor, rather than recommended or purchased by family or other caregivers.)

2) Only 50-60% of users wear their portable help button all the time, thereby diminishing the potential effectiveness of the product.

The discussion quickly turned to the design features of the product.

Paul Grayson mentioned the importance of seeking a design with broad appeal and easy access. "It should be attractive not just to the elderly," he said, "but to people of all ages, not just to the frail or disabled, but to everyone. Such an approach would result in 'universal design.' That is, products designed for all, not just those with specific needs."

Gari Lesnoff-Caravaglia said we should learn something about the aesthetics of frail elders. Margo Holm suggested research on the sensitivity of the switch for weak users, and Len Singer recommended voice activation in lieu of the button in current models. The participants offered various ideas for "disguising" the transmitter, such as fashion watches, pendants, religious objects and rings. K.G. Engelhardt advocated more lightweight products. She related the story of her mother's death from a heart attack while not wearing her PERS. The product (not Lifeline) weighed one pound and had to be attached to a belt. Engelhardt's mother found it uncomfortable to wear and, thus, often went without it.

Dibner discussed the future of Lifeline. Since the technology will be in the homes of so many, what other needs could it be adapted to address? The company is seeking to expand the product's potential in other health-related areas, he said, as a transmitter of diagnostic information, to update physicians, and report failures and interruptions in therapeutic devices, such as artificial feeding. While several participants suggested the application of PERS to security and wandering applications, these are not part of Lifeline's current business plans.

III. TEL-C (TEL-Communicology) and REMATE (Remote Machine-Assisted Treatment and Evaluation)

> *If we want to be different, it's because we are beautiful, because we sing or wear designer clothes, not because we are different physically.*
>
> Gwenyth R. Vaughn

> *None of us wants to say to her, 'Accept your disability. Stay home and get a Lifeline button.' People always resist. We all want to fight against death and frailty. We don't want to go gently into that good night.*
>
> Scott Hauger

Gwenyth Vaughn was doing double duty at the conference. Chief of Audiology-Speech Pathology Service at the Birmingham, Alabama, Veterans Administration, she also has a physical disability, which came to her in mid-life. During this session she told us of her work and her personal struggle:

> "In rehabilitation too often we say to the patient, 'This is your problem, this is what you have to do, and, if you don't do it, you're not going to improve.'
>
> "What we should do instead is ask that person, 'What do you see as your problem?' . . . 'What do you want to do about it?' and 'Can we help you?'
>
> "The problem is one of coping. Many persons do not want to identify with other disabled people. Some persons reject the technology that might help them. Others dedicate themselves to developing new aids and educational programs to bring acceptance, availability and acceptability."

While Vaughn helps hearing-impaired persons in her work, she herself has an ambulatory problem. Those of us who watched her make her way with her walker across the winter ice at Wye found it hard to imagine this determined woman confined. She recalled her feelings toward others as a result of their approach to her as a disabled person; people who cannot accept or help her are generally unable to handle their own problems, she believes. "Thus, they cannot help others."

> "Everyone has an individual threshold for coping with personal disability and that of others," Vaughn said. "Some disabled people become kinder and more caring. Others act in the same way as the people who reject *them*—indifferent and self-centered."
>
> "When I was in the hospital, I realized that the psychology of relating to people from a bed and a wheelchair was very different from that of a standing person. You are powerless, and you function from a subservient position. Persons with disabilities need to find technology that helps them to be as independent as possible. New devices and procedures can contribute greatly to improved interpersonal adjustment and personal independence."

"Now, people think I had a stroke," she said, referring to her walker. "As a result, they assume I cannot think, speak or feel. They shout and talk to me like a child."

Vaughn, who could suffer greatly from a fall, might be considered by some a candidate for an emergency alert response system. A strong and stalwart woman, she created silence in the room with her personal admission. "The first step is to recognize you have a problem, cope with acceptance and give up struggling," she said. "I refuse to acknowledge my disability," she told the group. "I am much more incapacitated than I appear."

Do existing or modestly enhanced telephone technologies have application for the care of frail elderly at home? In this session, Vaughn and Robert Friedman described two systems with which they are currently working.

In Birmingham, Alabama, Vaughn supervises 126,000 TEL-C visits a year to veterans and others from the Veterans Administration Hospital. TEL-C stands for Tel-Communicology Communication Outreach, a remote system for telephonic delivery of clinical and educational services to persons with speech, language and hearing disorders. It is of particular value to patients facing travel barriers such as distance, cost or disability.

The Birmingham VA offers three kinds of TEL-C calls:

1) Clinician assisted telecommunication

2) Machine assisted telenotes, notebooks, etc.

3) REMATE—Remote Machine Assisted Treatment and Evaluation—an innovative way of using telephone and computer for supplementary services, designed to free the clinician from the session

REMATE calls are initiated by a touch-tone system on the patient end. One of the most popular uses is for patients who are learning esophagal speech. Twenty-minute telephone language learning sessions are combined with face-to-face lessons scheduled when the patient has to come to the hospital for other reasons, such as to see the doctor. Some patients even take their lessons from public pay phones! The average schedule is several times a week for six to eight weeks, then once a week thereafter, Vaughn said.

In Boston, Robert Friedman utilizes a similar technology at University Hospital where he is Chief of the Medical Information Systems Unit. A touch-tone phone in the home communicates with a computer that controls a synthetic speech device. The patient is able to carry on an automated conversation using the touch-tone buttons to respond to the "customized" questions asked by the telephone computer system. The data inputted by the patient is then automatically transmitted to the physician's office.

Known as Telephone-Linked Computer System (TLC), the technology is part of an experimental program for individuals with chronic illnesses. The purpose is three-fold, Friedman said:

1) To improve monitoring between office visits

2) To help the home-bound person be a better patient by more assiduously carrying out self-care regimens such as taking medication, diet, etc.

3) To increase communication between the patient and the provider

TLC speech was devised to be as humanlike as possible, and, indeed, Friedman told of patients who have personal feelings for "him" (the voice). "The patients feel more secure because they know their doctors are more informed between visits," Friedman reported. "Feeling more connected seems to be a key to their compliance."

Participants were particularly interested in what a TLC conversation would sound like, and Friedman was able to initiate one on the Wye speaker phone.

After a preliminary conversational salutation, the computer asked questions about blood pressure, treatment regimen, "compliance" and side effects. The "patient" was instructed to "push 1 for yes," "push 2 for no," and so forth. The 75 patients in the experimental program are definitely satisfied, Friedman reported, perhaps because it gives them something to do during their long days. The program has suffered no attrition.

Summing up after these two presentations, Michael Rice pointed out the apparent efficacy of existing or modestly enhanced telephone technology as a "tool" for facilitating and enhancing the lives of frail elders. "The technology is simple to work, people will use it, and it has significant impact on health care delivery," he said.

Kerry Petrucci raised the question of who will pay. Robert Friedman replied that, with regard to his experiment in Boston, "We don't know yet." However, the costs are modest, about twenty-five cents per call. Mary Jo Brandt, a physician and television producer with Provident Media Productions, Inc., suggested the need for more refined outcome data to assess the efficacy of telephone technologies. Friedman responded that he is evaluating TLC in a clinical trial sponsored by two federal agencies.

IV. Robotic Technologies

> **robot** *n* [Czech, fr. *robota* work; akin to OHG *arabeit* trouble, L *orbus* orphaned] **1:** a machine that looks like a human being and performs various complex acts (as walking or talking) of a human being; . . . **2:** an automatic apparatus or device that performs functions ordinarily ascribed to human beings or operates with what appears to be almost human intelligence **3:** a mechanism guided by automatic controls
>
> Webster's New Collegiate Dictionary

What constitutes a robot?

K.G. Engelhardt started us off with her definition. Engelhardt is Senior Research Scientist and Director of the Health and Human Services Robotics Laboratory at Carnegie Mellon University's Robotics Institute.

"If we talk about machines that sense, think and act, we are helping define robotic technologies," she said. Recent advances are creating "systems" to benefit or enable humans and increase their productivity.

Today, robotic technologies transcend the traditional notion of a mechanical arm and can encompass whole environments, Engelhardt continued. She described the spectrum of such technology as ranging from the microwave oven (it senses, thinks and acts) to so-called "smart cities."

Robotic technologies hold potential to serve frail elders in several ways:

1) Increasing independence for caregiver and carereceiver
2) Increasing job satisfaction and productivity
3) Increasing quality of care
4) Improving economics of service delivery

How should robotic technology be introduced to frail elders?

"People are not afraid of robots if they are introduced to them in a non-threatening way," Engelhardt insisted. "Before we conclude that the technology has failed, we need more scientists, engineers and clinicians in interdisciplinary teams examining systems and applications together."

As an example, she described her work with mobile robots. "They are like slightly disabled persons. We need to eliminate the same barriers for them as we do for people."

The home environment is hostile and hazardous for a 75-year-old woman trying to reach the top shelf, but robots function well in such settings, Engelhardt explained. However, as with the personal emergency response systems, researchers in robotics technology must still address problems of human interface, design and acceptance.

One of the more successful experiments in this field has been the Robotic Vocational Work Station, Engelhardt reported. The work station was designed for persons with high-level upper-body disability resulting from spinal cord injury or stroke. The voice-controlled unit replaces manipulative function, not anatomy, she emphasized. The "office" version inserts floppy disks in a computer, staples paper and performs similar tasks.

Since they don't require sleep, robots can be put to work 24 hours a day, thereby making them more cost-effective in institutional settings. Engelhardt told of one example which is designed to work 8 hours a day with a disabled person and then shreds paper for another 8 hours. Labor costs for human paper shredders run $7-12 an hour, she said. Engelhardt's early research, targeted to long-term institutional environments, has identified 54 odious and/or boring tasks that can be accomplished by robots in nursing homes.

Apart from their benefits and the fascination that robotic technology seems to hold for many observers, our participants agreed that these developments also create new problems.

Engelhardt pointed out that "some robots don't have fronts or backs," and, therefore, it is sometimes difficult for humans to identify correctly "right" or "left." Perspective and orientation must be understood in issuing commands, possibly a problem for some frail elders.

"The field needs more interdisciplinary work to define and analyze tasks, then seek robotic applications," Kerry Petrucci said.

Several home applications were suggested, such as voice synthesis to remind elders of their medication, "smart home" monitors to detect falls, and smoke alarms, areas of research that are currently part of Engelhardt's work at The Robotics Institute. Kitchen robots, which dispense and monitor fluids, time of eating and so forth, could be lent or leased to chemotherapy patients and others in need of feeding or food preparation assistance. Robots capable of housekeeping chores, including laundry, could be of use to frail elders in rural areas. In hospitals, bar-coded patient trays could determine how much food was eaten and track nutrition for patients in long-term care. Other suggested applications were for blood analysis and security.

Paul Grayson described innovative robotic technology applications in other countries such as paperless toilet machines, which wash and air-dry users, for people with upper-body disabilities. However, he cautioned, "robotic technology requires 'deep pockets' and the kind of long-term commitment often lacking in the U.S."

Andrew Dibner and Scott Hauger countered with a reminder that ours is a market-driven economy. "Especially with new products," Hauger pointed out, "people can't conceptualize certain things until they interact with them. One hundred years ago, no one said they needed an auto. We need to find clever ways to harness user involvement."

Allan Meyers mentioned that frail elders may not be able to articulate their needs because of cognitive impairment. The caregiver may then become the consumer, Engelhardt suggested.

Looking to the future, Michael Rice asked whether we should expect multipurpose robots or different ones for different tasks, much as we have become accustomed to different specialized appliances. It will be 25-50 years before we see widespread multipurpose robots, our group expert K.G. Engelhardt stated. "Robots for specific task domains already exist and will continue to increase and become more multiple functioned. I do not think there will be a 'general purpose' robot."

"Robotic development is similar to that of humans," she concluded. "Now, we are at a stage of six months to two years. The first developments have been specialized kitchen robots, specialized office robots and so forth. I believe we are working toward more complex systems—multipurpose robots similar to teenagers and adults—but we are not there yet."

Several participants then encouraged Engelhardt to skip the teenage stage.

V. Interactive Television

Michael Rice, once the manager of a major public television station, reminded the group that television and the viewing experience seem to be more prominent and of greater importance in the lives of the elderly, whose time spent watching may even exceed that of other population groups.

For many elders, the schedule of daily life is determined by game shows, the local news, situation comedies, and sports on television.

"Is there anything wrong with that?" Rice asked. "Can we regard it as benign?"

"When I was in TV," he continued, "the ideal world would have been one in which everyone got to produce, not just watch, television. Is there a way it can be made less passive, more interactive, more stimulating? Is there a way of using the medium to undo its worst effects?"

What examples can we seize upon as ways of problem solving, particularly in community life? How can seniors use the medium to allow them greater participation in politics?

Our participants did not have many answers, but were quick to point out that passive television was not evil in itself.

"Better something than nothing, which is the alternative for many people," voiced Gari Lesnoff-Caravaglia. "Many recreational activities are passive, such as reading and movies. Television fills a vacuum for frail elders, and that is good."

Allan Meyers agreed that he "hates it," but television serves a purpose. "Until we are prepared to offer better, we should be careful before we take away what is meaningful and enjoyable," he said.

Margo Holm added that VCRs can offer alternative stimulation to available programming and that they are an important backup for caregivers. In addition, she pointed out, patients with limited mobility, who may not be able to perform such functions as brushing their hair, can still often operate television controls and derive some feeling of independence from that.

Other suggestions for use of electronic media by frail elders included shopping channels, opinion polling, health information, exercise programs and talk show radio.

VI. Personal Computers

Our lively session on personal computers elicited numerous suggestions for use of this technology in the home and in institutions, as well as by caregivers. But will frail elders use computers?

Some might, if they already have keyboard skills, several of the participants concurred. Mary Jo Brandt noted the importance of increasing the familiarity of 45-60-year-olds with computer technology.

"We must give this group more comfort," she said. "We must increase their familiarity from passing contact with technology to a working intimacy such as they have with the phone and TV."

"We had no trouble introducing the microwave to the elderly," Len Singer pointed out. "It looked like a toaster oven."

Andrew Dibner focussed the discussion by drawing up a list of motivations frail elders might have for learning computer technology: memory jogging, record keeping (especially their own and pets' medical records), bookkeeping, continued learning, maintaining a social life and sense of community, amusement, reminiscing, having a creative outlet, sustaining a productive old age.

Shirley Bagley, Assistant Director for Special Programs at the National Institute on Aging, picked up on the last point. One of her professional interests is involving the elderly in the workforce, particularly for paid employment. "Just because they are frail does not mean that they are cognitively impaired," she reminded the group.

The discussion prompted Abraham Monk to refer to earlier remarks about the fear of lost independence among frail elders. "Computer applications like record keeping can help them regain a measure of control," he said.

We turned to the question of how to make personal computers more user-friendly. There was general agreement on three points.

1) The program should not require a great deal of learning.

2) It must be simple to operate.

3) It must be simple to correct mistakes.

Touch screen and voice-activation were touted as among the most accessible interface technologies. Features such as enlarged print and auditory feedback for keys were praised for uses such as recipes and labels for bills. Popular games such as Scrabble and Wheel of Fortune, widely available on software, can be hooked into a TV screen to produce large images. With the addition of easy-to-operate computer interfaces, electronic mail and video-scan photos could enable frail elders to communicate with families and friends. Such communication, it was repeatedly pointed out, is enormously important to their well-being.

Kerry Petrucci examined the application of computers to care for frail elders in four functional categories: diagnosis, intervention, entertainment and administration.

In the diagnostic area, Petrucci reported, personal computers are being used for neuropsychological testing and hypertension biofeedback monitoring. The latter can be transmitted to medical personnel from blood pressure and finger cuff units in the patient's home. Aphasics have also been able to communicate biophysically with others through the use of such machines. Medical researchers are using computers to study movement disorders, especially the effect of certain medications for memory loss that cause tremors. Finally, Petrucci mentioned the use of computers to measure brain atrophy through patient pattern recognition.

Patient care and intervention has been assisted by the use of computers in intravenous infusion pumps for morphine, chemotherapy agents and other drugs. Such systems, which have been used with children for 10 years, allow elders to function at home and manage their own pain.

"Expert system" technologies allow patients to seek consultations with medical authorities through interactive programs. This technology has also proven beneficial to caregivers.

To what extent frail elders can use personal computers as memory aids is unclear, Petrucci concluded, noting her own lack of confidence that this application will prove fruitful. "Frail elders suffer from too many problems," she said. "They have limited attention spans, they can't read well, they can't write and they have difficulty coordinating movement."

The use of computers as entertainment, on the other hand, is enormously beneficial, she said. "Patients use the mouse to do artwork (excellent for stroke patients) and enjoy computer games. Even if they don't learn, they are engaged. It is a great help to the cognitively impaired and, for others, it is satisfying to be able to use the new technology."

In the area of administration, Petrucci cited the use of personal computers by health-care institutions to track patient information and to schedule patients for diagnostic tests, match roommates, and perform quick functional assessments. She also mentioned two software packages on which she is currently working. One, called "Carefinder," helps match Alzheimer's patients with appropriate care resources in their communities. Another is an intake package for nursing homes, of particular importance with regard to frail elders who may be helpless if they become lost.

VII. Attitudes of the Elderly Toward Technology . . . Attitudes of Technology Companies toward the Elderly

We all want to be part of the Pepsi Generation and take our vacations in Marlboro Country. Can we imagine ourselves in old age with a machine at our bedside, in lieu of family or significant others?

Gari Lesnoff-Caravaglia

Lesnoff-Caravaglia, whose perspective stems from her work at the National Clearinghouse on Technology and Aging at the University of Massachusetts Medical Center, helped us synthesize our inventory of technologies by addressing the attitudes of elderly consumers and manufacturers toward technology.

"We are living through a fast and challenging period in human history," she said. "The time is characterized by two megatrends: increased growth of the older population (especially 85 plus) and rapid and extensive advances in technology that reach into areas of human existence we have never seen before, even the private life and work spaces of persons."

Enormous change in the attitudes of professionals toward the needs of the elderly has already taken place, she continued. But, as reflected in the slow development of technologies, attitudes of consumers and manufacturers are complex and have been negative. "There is a feeling that this is a population that may not merit attention," she said. "As a whole, they are considered a non-productive group and uninterested in technology. Is the investment worth it? Who will pay? We are talking about expensive resources."

One possibility for future research in this area derives from the ironically comparable needs of astronauts in space and frail elders, e.g., exercise, elimination and mobility, Lesnoff-Caravaglia said.

Len Singer raised some doubt as to the applicability of space-age solutions to the needs of our target population. "We get more conservative as we get older," he said. Simple technology, like digital watches, is readily accepted because it easily enhances the wearer's life and provides continuity and familiarity. "Deriving tactile, sensory and olfactory meaning out of things is critical to their acceptance," he said.

Scott Hauger advocated finding new terms for marketers to replace language like "technology for aging." Such terms are rejected by elders, business and the public at large, Hauger maintained, because the needs of elders are no different from younger people. He suggested phrases such as "technology for living," "technology for comfortable living," and technology for "safe living at home." In addition, he suggested examining what frail elders might want to communicate from home such as knowledge, opinions, votes and work. "We have the right technology for polling, but the right questions aren't being asked," he added.

Andrew Dibner agreed that marketers will play a significant role in increasing the acceptability of technology to frail elders. "They will assess who will pay," he said. "They will assess the potential receptivity." Foundations and government, Hauger noted, will be important in the funding of research and development. Mary Jo Brandt suggested that marketing to functional and impaired groups, rather than age delineated sectors, may be a solution.

Michael Rice raised the question as to whether third-party payments redefine the market test to one of a subsidy mechanism. Our participants agreed that confusion over who will benefit and who will pay has impeded progress on all fronts. Shirley Bagley observed that the development of products of use to the entire population, such as thermostats with large dials, remote light switches and locating devices for wandering children and elders, will stimulate interest among manufacturers.

Brandt suggested that further research in adult development and the resistance to change among frail elders would assist product designers in creating new devices. "It is critical to learn what elders, both frail and hardy, desire as well as need," she said. "Further, any conclusions drawn from the current population 65 and older will require reassessment and possible revision when those reared in a culturally different period arrive at that older stage."

Robert Friedman added that we should not overlook the normal process of aging. What people need to do, what they can do and their need for a psychological feeling of independence all need to be assessed, he said.

Margo Holm advocated further work on the need for personal control. "What do people value most?" she asked. "Their ability to use the toilet alone? To feed themselves? Mobility?"

Paul Grayson, a practicing architect for over 30 years, recalled his frustration that manufacturers of roofing, glass, plumbing and other suppliers did not talk to others with whom their products had to interface. "There is too much fragmentation," he said. "We need a more holistic approach. Japanese manufacturers do a much better job of considering health and well-being issues in housing."

Rice questioned whether the holistic approach might be too broad to provide a practical solution. "It assumes a comprehensive technology which can answer our toilet needs, give us our appointments, take us to the polls and perform other specialized functions," he said. "That's a substitute human being."

Most of the group agreed that more interdisciplinary meetings were needed to address the needs of people, the requirements of the environment, and the nature of tasks needing the assistance of technology.

"It's rare that a problem can be addressed by a single technology," Robert Friedman summed up. "We need to develop basic technologies (like robotics), show their competitive advantages, and glue them together to serve enough of a critical mass so that they will be able to benefit the target population."

David Colvin, President of Triangle Research and Development Corp. in North Carolina, drew the discussion to a close by asking, "What can the elderly do for us?"

"My 94-year-old aunt feels like a useless person," he said. "Repeatedly, she asks us, 'Why doesn't God just take me on?' I want to be able to tell her that she isn't useless . . . that the wisdom of aging is her gift to us."

"We have done better with the extension of life from a quantitative point of view than a qualitative one," he continued. "Even our youth have a negative view of aging because they fear depleted Social Security resources when their time comes."

How can we improve the image of aging for society as a whole?

"We must adapt technologies that will enable elders to extend their usefulness to us and to feel themselves useful," Colvin concluded. "They are the wise and they can return so much back to us. If we can help them do that, we will be a better society."

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